



Climate change response in New Zealand communities: Local scale adaptation and mitigation planning

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ABSTRACT

This paper investigates climate change adaptation and mitigation planning responses of New Zealand communities, using an online survey of local elected representatives. Climate change is affecting New Zealand through changes in precipitation patterns, increases in temperature, changes to the frequency and duration of droughts, sea level rise, and the increased occurrence of extreme events. These impacts highlight the vulnerability of key economic activities, communities, and infrastructure. As environmental and socioeconomic vulnerability varies with place, local level climate change policies are important tools to increase resilience when faced with a changing climate. The research survey, targeted towards local elected representatives, unpacks local scale climate change planning efforts across the country, as well as decision-maker perceptions of barriers and motivations in the area of climate change planning. Findings suggest that increasing local-scale responses hinges on public perception of the urgency of climate change, which is heavily influenced by national priorities. Furthermore, support for national level responses is limited by a collective view of climate change as an issue of an uncertain future, rather than one of present concern. Thus, the inclination to act at the local level is to some extent undermined by slow national action.

1. Introduction

The effects of climate change are being seen around the globe through impacts including changes in precipitation patterns, increases in temperature, changes to the frequency and duration of droughts, sea level rise, and increased occurrence of extreme events. These impacts highlight the vulnerability of key economic activities, communities, infrastructure, and industries. Governments around the world are already dealing with these impacts through a combination of mitigation and adaptation planning and actions. The extent of future climate impacts is largely dependent on global decisions about decarbonization, but emissions to date have already locked in significant amounts of climate change (IPCC, 2013). While international greenhouse gas emission target-setting negotiations and actions will influence the extent to which nations will be affected in the medium-to-long term, immediate impacts require real-time, place-specific planning and action (Measham et al., 2011; Biesbroek et al., 2009). Thus, adaptation is and will become increasingly necessary, with localized effects of climate change putting municipal decision-makers on the front-lines of

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the climate battle (Krause, 2010; van Aalst et al., 2008; Archie, 2014; Hsu et al., 2017). At the same time, it is clear that there is a key role for subnational mitigation action, especially where national level mitigation strategies are contested (Somanathan et al., 2014).

In New Zealand, there has been growing concern expressed at local government level about the response of central government to the climate challenge, with considerable interest in and planning for mitigation at regional and city level (e.g. Auckland Council, 2014; WCC, 2016), but also debate about the respective roles of local and central government (Chapman, 2017). For instance, the Chair of Greater Wellington Regional Council, when asked on 8 August 2017 if he thought enough was being done in Parliament to address climate change, stated: “No, I don’t. That’s one of the reasons why the local government community as a whole decided that they really have to take their future into their own hands. There’s a lot more central government can and eventually will do but we want action more rapidly than that.” (Radio NZ, 2017).

This paper draws on the results of an online survey of elected representatives across New Zealand, focused on determining the extent of local scale adaptation and mitigation planning. The following section provides a contextual overview of New Zealand’s geography and climate vulnerabilities, its governance structure in relation to climate change issues, and local responses to climate change. This is followed by an outline of the paper’s research methods and analysis of the online survey results. A detailed discussion is followed by a conclusion highlighting the principal findings and original contribution of the research.

1.1. The New Zealand context

1.1.1. Geography

A geographically isolated island nation encompassing an area slightly larger than the UK, New Zealand has a maritime climate, which varies dramatically across the landscape from sub-tropical coastal areas to high-alpine ecosystems. Such dramatic differences in local climates makes national scale prediction of future changes challenging (Hopkins et al., 2015; Reisinger et al., 2014). Due to ocean buffering, New Zealand will likely experience reduced warming compared to the global average (Hopkins et al., 2015). Thus, the forecast risk from climate change in New Zealand can appear less severe than in neighboring countries such as Australia. However, recent work already shows changes in precipitation patterns, warming temperatures and sea level rise (Reisinger et al., 2014; Hannah and Bell, 2012). These impacts coupled with relatively high exposure rates mean that delayed, incremental or reactive responses could dramatically increase vulnerability (Manning et al., 2015). Across New Zealand, over 100 years up to 2015, the average relative sea-level rise was around 1.8 millimeters a year. This figure is based on 10 sites around the coast where sea level is measured (MfE, 2017a). Extreme rainfall patterns in New Zealand are expected to increase by up to 8% with each 1 °C of warming, but with significant regional variations (IPCC, 2013). Time spent in drought in eastern and northern New Zealand is projected to double or triple by 2040 (IPCC, 2013).

1.2. New Zealand’s coupled economic and climate change vulnerability

New Zealand’s economic reliance on international trade and current patterns of coastal development make both human and natural systems vulnerable to the impacts of climate change. Coastal regions in New Zealand are vulnerable to sea level rise (SLR) and extreme weather events, with New Zealand potentially experiencing a rise in sea level that is 10% higher than global averages by the next century (Hollis, 2014). New Zealand has high proportions of urban and suburban populations living in low-lying coastal areas where continued development creates coastal squeeze conditions, preventing natural habitats and defenses, such as wetlands, dunes and beaches, from migrating inland (Bell et al., 2001; Peart, 2009). These coastal residents are at risk from rising groundwater, aquifer salination, coastal erosion and flooding (McGranahan et al., 2007; Bjerklie et al., 2012; Manning et al., 2015). In addition, potential changes in precipitation patterns and increased incidence of large storms will increase the risks of river flooding (Gluckman, 2013).

Current estimates suggest that as much as 79% of New Zealand export services and products could be impacted by changes in climate (Hopkins et al., 2015; Fitzharris, 2007). Key New Zealand resource based sectors, including dairy and tourism, rely heavily on export markets and both could be significantly impacted by climate change. For example, changes in precipitation timing and quantity will affect rainfall-reliant agriculture and could have lasting impacts on the primary industry (Kamber et al., 2013; Hopkins et al., 2015). These impacts are already being experienced, with the drought of 2013 reportedly lowering the country’s annual GDP by as much as 0.6% (Kamber et al., 2013). Although decreases in New Zealand’s snowpack are expected at both high and low elevation ski areas, winter tourism in New Zealand could benefit from more dramatic decreases in Australian snowfall which would entice Australian skiers away from their domestic resorts (Hendriks et al., 2013).

New Zealand is vulnerable to both economic fluctuations in international markets as well as global perceptions of the sustainability of New Zealand products and services best exemplified by the New Zealand wine industry (Flint and Golcic, 2009; Gabzdylowa et al., 2009; Lawrence et al., 2006). Protecting the “clean, green, 100% pure” image of New Zealand is a top priority nationally and one which demands engagement with global climate agreements and regimes (Kaefer, 2014; Hopkins et al., 2015; MfE, 2001; Bibbee, 2011). Though “clean, green, 100% pure” was initially a tourism-focused marketing campaign, the branding has stretched to include New Zealand export products and implies environmentally sustainable practices. However, recent environmental concerns, including over rising greenhouse gas (GHG) emissions, have prompted international media criticism of the ‘clean, green’ image, and the long-haul travel necessary for most visitors to reach New Zealand presents environmentally conscious travellers with a conflict of interest (Howe, 2012; Coyle and Fairweather, 2005; Kaefer, 2014).

1.3. Climate policy

Though New Zealand's total GHG emissions are relatively small, constituting a mere 0.15% of the global total, CO₂ equivalent per capita emissions are high, 17.4 tonnes per person per year (in 2015), and gross emissions increased 24% between 1990 and 2015 (MfE, 2017b). For comparison 2015 CO₂ equivalent per capita emissions in Australia are 22 tonnes, United Kingdom 7.5 tonnes and Japan 10 tonnes (MfE, 2017b). Despite high per capita emissions, ratification of the Kyoto Protocol and establishment of an emissions trading scheme (NZ ETS) have positioned New Zealand relatively well in global climate regimes. Conscientious participation has been seen as not only consistent with a “trail-blazing” national identity (Barker, 2012) but also vital in maintaining the environmental sustainability that, while increasingly challenged, still supports New Zealand's ‘clean, green’ image.

The cornerstone of New Zealand's national climate efforts has been the ETS, which is globally unique in its inclusion of the forestry sector (Adams and Turner, 2012; Karpas and Kerr, 2011). Though clearly an achievement in itself, the ETS has been largely ineffective in reducing emissions because of its low prices, resulting from the availability of cheap international units and exemptions for agriculture (Leining and Kerr, 2016). Exempting agriculture from the NZ ETS is significant as, unlike most Annex I nations, GHG emissions from agriculture make up the largest portion of NZ's total emissions, at 48% of the 2015 total (MfE, 2017b).

1.4. Governance and local level responses to climate change

Traditionally, mitigation has received the major share of attention from both the New Zealand government and the media (Boston and Lawrence, 2017), but recently policy makers and scientists have shifted some of their focus to adaptation (Manning et al., 2015; Gluckman, 2013; Nottage et al., 2010; Evans et al., 2014; Hayward, 2008). The economic and cultural significance of New Zealand's long coastlines and many coastal settlements makes coastal adaptation a top priority both locally and nationally, and progress has been made in some areas (Lawrence et al., 2016).

New Zealand's central government has devolved adaptation responsibility to local governments; under the Resource Management Act (RMA) and the Local Government Act (LGA), local government in New Zealand is required to take into account the effects of climate change. The approach, which is supported by the NZ Coastal Policy Statement and other management guidance documents, is precautionary and promotes risk based decision-making (Manning et al., 2015). The highly variable climate and diverse landscape of New Zealand makes national-scale climate projections impractical for planning at local scales, and downscaling of climate projections introduces an often unmanageable amount of uncertainty (Giorgi et al., 2009). Therefore, improved understanding of local scale risks and potential impacts is vital for effective planning.

The data presented in this paper fills a gap in understanding about local scale adaptation and mitigation efforts across New Zealand. Until now, understanding has been essentially limited to national level decisions and particular regional investigations, mostly through in-depth case studies (King et al., 2008; Niles et al., 2015; Kenny, 2011; Niles and Brown, 2016; Manning et al., 2015; Cradock-Henry, 2016; Chapman et al., 2017). As previously mentioned, New Zealand's highly variable geography makes generalizations about potential impacts and responses unsuitable for local scale planning, while the decentralized approach to adaptation allows for locally relevant decisions but could lead to a piecemeal approach. Before advocating for additional action at the local level it is important to assess the current status of nation-wide, local scale, climate change efforts as well as decision-maker perceptions of barriers and motivations.

2. Methods

In order to obtain data about local scale adaptation and mitigation planning and action in communities around New Zealand, an online survey of local elected representatives was conducted building upon previous work on similar topics (Amundsen et al., 2010; Theoharides et al., 2009; Tribbia and Moser, 2008; Archie et al., 2012; Archie, 2014). Local government in New Zealand is made up of 78 local, regional and unitary councils, plus 137 community and local boards. There are approximately 1600 locally elected council and board members in total. For this study, qualified survey participants included elected members of regional, district (including city) and unitary councils and community and local boards. Thus, the sample considered here includes individuals making municipal decisions at a variety of scales.

The survey was pre-tested with a small group of local officials from both the North and South Island to ensure the questions were relevant to the intended audience. Minor changes to the wording of a few questions were made per the comments of the pre-testers. The survey was sent via email to 1292 of the roughly 1600 local elected officials in New Zealand. Contact information was obtained using publicly available lists of email addresses on council and board websites. Potential respondents for whom a valid email address was unavailable were excluded. Systematic inclusion of almost all local elected officials around the country allows for broad understanding of responses regardless of regional or climatic differences; however, this is not necessarily a statistically representative sample. Respondents were emailed a link to the survey a total of four times between October and December 2014. The survey was composed of 27 voluntary questions of various types (e.g. forced-choice, ranking, Likert scale). Responses to individual questions were voluntary, thus some questions received more responses than others.

Out of the 1292 emails sent, 341 officials responded, making for an overall response rate of 26%. The sample analyzed is made up of 15% regional council members, 42% district council members, 14% city council members, 3% unitary council members and 26% local and community board members. In order to understand geographic differences in responses but also maintain confidentiality, respondents were asked to provide their post code, but were not asked to name the exact governing body for whom they work. Responses were received from 199 postal codes with no individual code accounting for more than 2% of the sample (Fig. 1). More

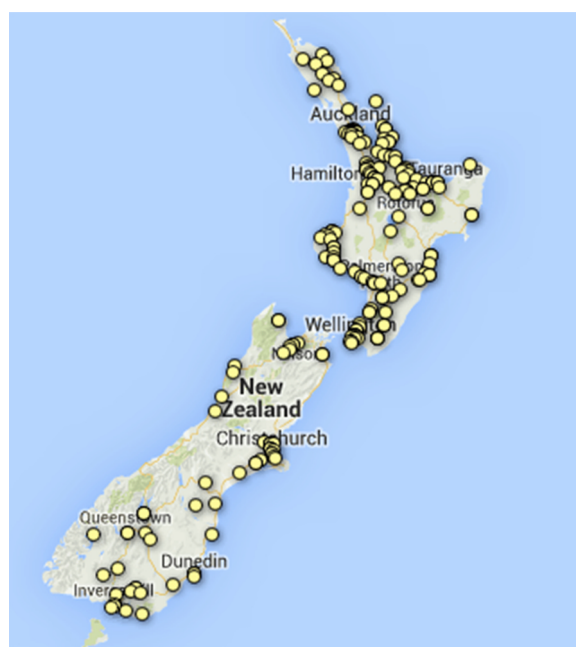


Fig. 1. Map of respondent post codes.

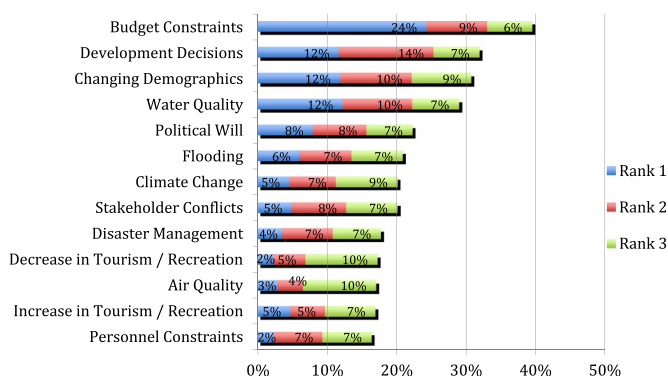


Fig. 2. Respondent reports of the top three management challenges in their community, with “1” being the most important challenge (by total responses) (N = 248).

responses were received from officials in the North Island, which is consistent with higher populations. Sixty-six percent of respondents were male and 54% of respondents had completed at least a bachelor's degree with 30% having completed a post-graduate degree.

Results were analyzed using simple statistical procedures including cross tabs, ordinary least square regression analysis, and ordered logistic regression analysis, using the standard statistical software packages, SPSS and Stata.

3. Results

3.1. Challenges facing New Zealand communities

To start, we examine respondent perceptions of the relative importance of climate change as a management challenge in their community. When asked to choose the most important management challenges, the most common responses were: budget constraints, development decisions, changing demographics and water quality. Climate change was the top challenge for only 5% of the survey respondents ranked (Fig. 2).¹ Issues such as living within budget constraints and managing water quality concerns loomed

¹ In this section we included climate change as a potential management challenge instead of specifically using a risk framework. Had we used a risk framework climate change may have ranked higher.

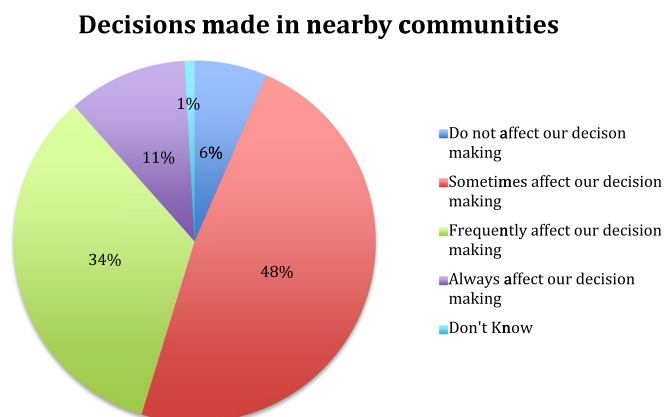


Fig. 3. Respondent reports of the extent to which decisions in nearby communities affect their own decision-making (N = 249).

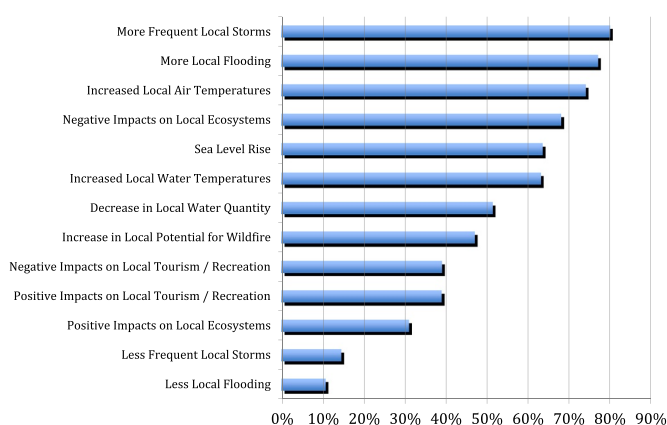


Fig. 4. Respondent reports of the likelihood of potential climate change impacts in their community. Bars show combined responses of moderate or high possibility. (N = 230).

larger for respondents. The 5% figure for climate change is likely to be reduced by the inclusion of flooding and disaster management as management challenges alongside climate change. Forty-five percent of respondents consider their most important challenge to be either severe or very severe with only 16% reporting their most important challenge as either slightly problematic or not severe at all. Therefore reported challenges can be assumed to require a significant amount of attention. This information provides context for subsequent questions that specifically address climate change by illuminating the general challenges that decision-makers perceive to be most pressing.

3.2. Geographically contagious decision-making

The effects of climate change do not conform to political boundaries. Thus, we explored whether decision-making can be geographically contagious. In other words, do decisions made in neighboring communities influence decision-making as reported by our group of respondents? Forty-five percent of respondents report that decisions of nearby communities frequently or always affect planning and decisions in their community while only 6% report that decisions of nearby communities do not affect their decisions (Fig. 3).

3.3. Perceived impacts of climate change and potential responses

One of our goals was to understand how representatives perceive local vulnerability to climate change. To address this question we asked respondents to rate the likelihood of 13 potential climate change impacts to their community. More than half of the respondents perceive more local flooding, more frequent local storms, increased local air temperatures, negative impacts on local ecosystems, sea level rise, increased local water temperatures, and decreases in local water quality to be at least moderately possible as a result of changes in climatic conditions. Respondents reported the following impacts as the least likely: positive impacts on local ecosystems, positive impacts on local tourism / recreation, less frequent local storms and less local flooding. Interestingly, these are the only options that were provided which framed impacts of climate change in a positive light (Fig. 4.). Reports of negative impacts

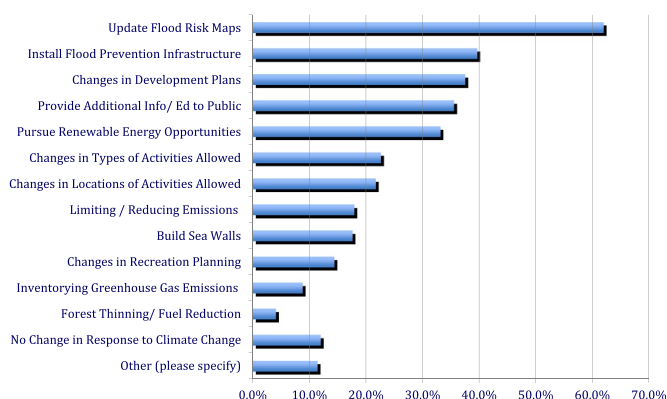


Fig. 5. The percent of respondents who report selected changes in management plans (current or planned) in response to climate change (N = 219).

resulting from climate change abound in the media, but reports of positive impacts attributed to climate change are much more rare. Therefore the tendency of respondents to view impacts as negative likely results from a lack of knowledge about the potential for positive impacts to result.

Of major importance to our study was understanding what types of changes respondent communities were planning to make or have already made in response to climate change. As shown in Fig. 5, at least one third of respondents report present or future changes by their community in the following areas: update flood risk maps, install flood prevention infrastructure, changes in development plans, and pursue renewable energy opportunities. These responses reflect both adaptation and mitigation measures. However, given that this question covered both present and future actions, it is surprising that more councils did not report a higher incidence and wider variety of management actions. Management plan changes around mitigation such as pursuing renewable energy opportunities, and limiting or reducing emissions were notably sparse; for instance fewer than 20% of respondents reported emission reduction plans.

3.4. Adaptation: reports of planning and perceived barriers

Of major significance to this research was establishing what stage New Zealand communities are currently at in terms of adaptation. To address this question, we asked respondents whether or not their council is currently planning for adaptation or already implementing adaptation plans. Roughly one third (31%) of respondents report no current planning for adaptation with 18% reporting that they don't know. Thirty-eight percent of respondents reported that their community was currently developing adaptation plans while 13% reported that adaptation plans were already in implementation (Fig. 6).

We examined which factors were influencing the status of adaptation planning and action and used demographic data and other potentially related variables to conduct an ordered logistic regression analysis. We were also interested in whether respondent attitudes and beliefs about climate change were correlated with reports of adaptation planning and action, and asked respondents a series of questions aimed at establishing a composite attitudinal variable. Roughly half of the survey respondents believe that climate change is real and already happening and that it is a serious or very serious problem (53% and 52% respectively), and 77% of respondents report that they are moderately or well informed about climate change. The results of the beliefs and attitudes questions were used in a reliability analysis which allowed us to compute a composite attitudinal variable (Cronbach's alpha = 0.85) that was then used as a predictor in our regression.

The results of our analysis showed that the degree to which respondents considered themselves to be informed about climate

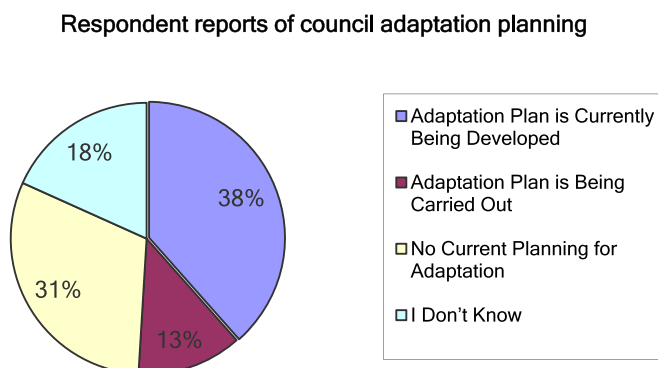


Fig. 6. Current status of adaptation planning for respondent councils (N = 228).

Table 1
Factors predictive of reported adaptation planning.

Ordered logistic regression analysis of adaptation planning				
Predictor	β	SE	z	p > z
Gender	− 0.549	0.361	2.311	0.128
Education level	0.01	0.099	0.011	0.916
CC belief index	0.184	0.091	4.138	0.042
Informed about climate change	− 0.807	0.249	10.517	0.001
Not a high priority in my community	− 0.696	0.324	4.599	0.032
Not a high priority in my office	− 0.847	0.236	12.881	0.000
Currently pressing issues are all-consuming	− 0.521	0.216	5.814	0.016
Cut 1	4.447			
Cut 2	− 1.762			

pseudo $R^2 = 0.29$, $n = 289$.

change, beliefs and attitudes about climate change, belief that climate change is not a priority in either their office or their community, and belief that currently pressing issues are all consuming were statistically significant predictors of adaptation planning ($p > |z| = 0.042$, $p > |z| = 0.001$, $p > |z| = 0.032$, $p > |z| = 0.000$, $p > |z| = 0.016$). On average, respondents with higher levels of belief in and concern about climate change reported higher levels of adaptation planning; whereas those who considered themselves better informed about climate change but who believed that it was not a priority in either their office or their community reported lower levels of adaptation planning and action. Similarly, respondents who reported that currently pressing issues were all-consuming reported lower levels of planning and action. Neither gender nor education were statistically significant predictors of reported adaptation planning (Table 1).

To understand why adaptation planning was not occurring more widely we asked respondents to rank the top three most important barriers to planning for adaptation. All respondents were asked this question whether they reported current adaptation planning or not. Budget constraints received the highest number of responses for being the top barrier. However, lack of locally specific information and not a high priority in my community were the two most common answers overall (Fig. 7).

To identify which factors were perceived by respondents to be preventing the implementation of adaptation plans (Fig. 8) respondents were given the option to designate choices as not a hurdle, small hurdle or big hurdle or to report that they don't know. The biggest perceived hurdle to implementing adaptation plans was lack of public awareness or demand to take action closely followed by lack of perceived importance to the public and budget constraints. Pressure to maintain the status quo and not a high priority in my office were the options that ranked the lowest as potential hurdles to implementing adaptation plans.

3.5. To what extent will adaptation plans differ from current plans?

Some actions that are labeled as adaptation are processes or activities that currently take place have merely been relabeled (D'Amato et al., 2011; Spittlehouse and Stewart, 2003). For example, updating flood maps and installing flood protection infrastructure could be considered adaptation, but could also take place for other, non-climate change, reasons. In an effort to differentiate between plans that were relabeled as adaptation and those which were designed to specifically respond to climate change, we asked respondents to identify the extent to which they expect adaptation plans to differ from previous management plans. Nineteen percent of respondents reported that there will be no change in planning in response to climate change, 37% expect slight changes in planning, 13% predict significant changes in planning and roughly one third (31%) were uncertain how plans will change in response to climate change. A response of “no change” could mean that current plans will be relabeled as adaptation or that respondents don't

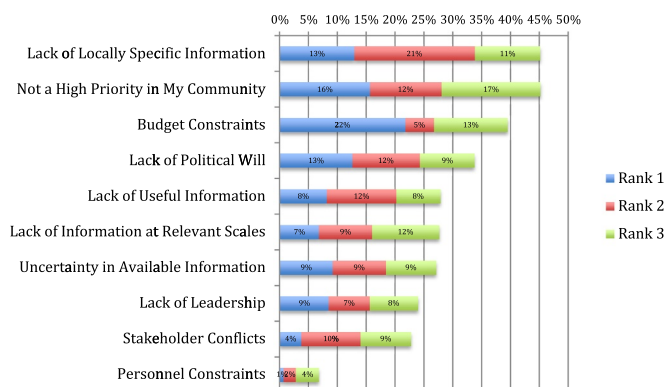


Fig. 7. Reported barriers to adaptation planning with Rank 1 as most important (N = 222).

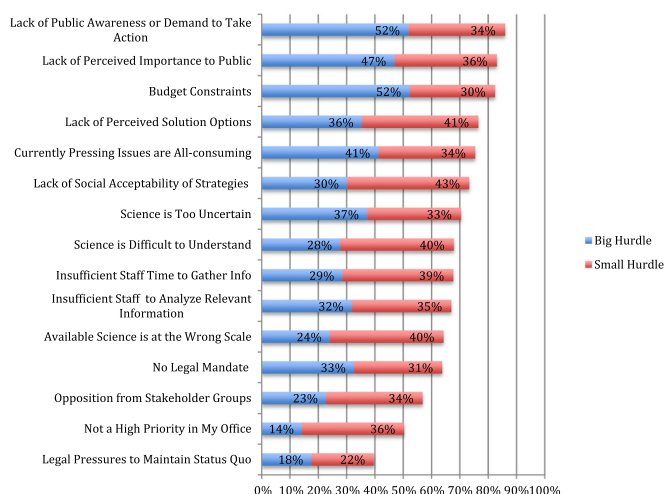


Fig. 8. Respondent reported hurdles to implementation of adaptation plans with options for choosing big hurdle, small hurdle, or not a hurdle. (N = 223).

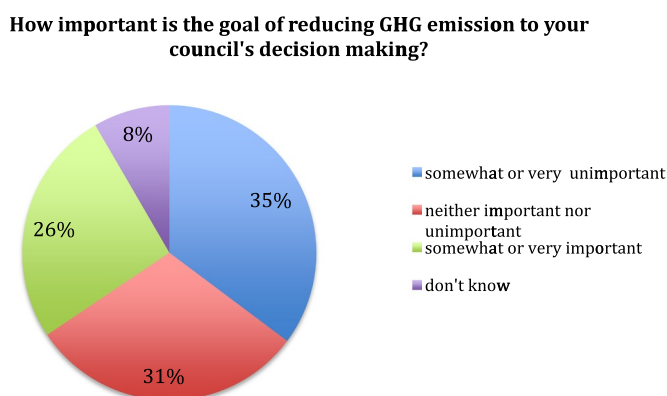


Fig. 9. Reported importance of reducing GHG emissions. (N = 199).

feel that there will be any changes made at all.

3.6. Current mitigation and motivating factors

In addition to questions about adaptation, respondents were asked about their current mitigation strategies, motivations and emissions reporting systems. When asked how important the goal of reducing GHG emissions was to their council's decision making, their responses varied dramatically. Twenty six percent of respondents report that reducing GHG emissions is either somewhat or very important while 35% report that this goal is either somewhat or very *unimportant* (Fig. 9). Slightly more than a quarter of respondents report that their councils have a mitigation strategy in place or under development for their own operations or the area under their jurisdiction (Fig. 10). Fifteen percent of respondents report current measurement and reporting of GHG emissions associated with their council's operations and a mere 13% measure and report emissions from the area within their council's jurisdiction (although around 40% of respondents did not know if their council measured and reported, or not).

Respondents were also asked to select which sectors or industries are or will be targeted by measures to reduce GHG emissions below business-as-usual levels. The waste sector and residential energy efficiency were the only two options that were chosen by at least one-third of respondents (Fig. 11).

In order to better understand why mitigation activities were not more widespread, respondents were asked which factors motivated their council to take actions that reduce GHG emissions. More than half of the respondents reported that economic and environmental co-benefits were motivating to their council. The least motivating option was contribution to global or national GHG emissions reductions objectives, which was chosen by only 25% of respondents. Because more significant action to reduce GHG emissions is a national and international goal, we wanted to explore which *additional* initiatives would motivate more significant council action to reduce GHG emissions. All the initiatives offered were seen by a majority of respondents as motivational, but the two most popular choices were greater public understanding of climate change causes and outcomes and greater public support for climate change mitigation (Fig. 12b).

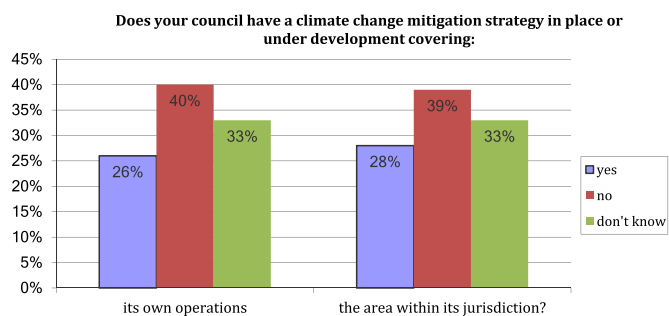


Fig. 10. Respondent reports of mitigation strategies. (N = 206).

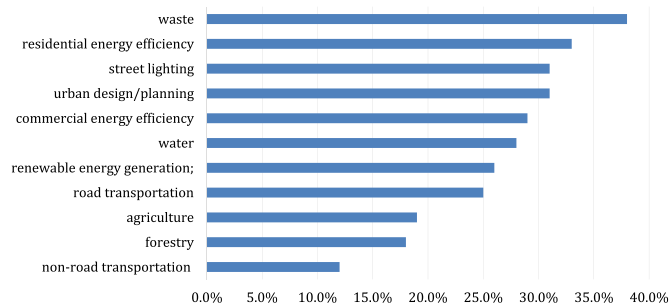


Fig. 11. Sectors or industries targeted by measures to reduce GHG emissions. Bars show the percent of respondents who chose each option. (N = 185).

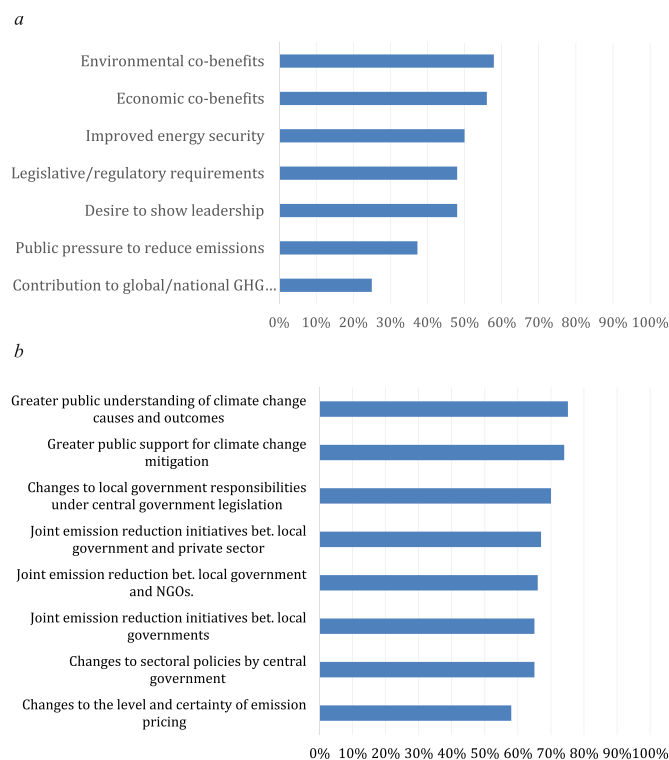


Fig. 12. (a) The extent to which specific factors motivate councils to take actions that reduce GHG emissions. Bars show the percent of respondents who chose an option. (N = 194). (b) The extent to which specific initiatives would motivate more significant council action to reduce GHG emissions (N = 199).

4. Discussion

Neither climate change itself nor the issues most directly related to it (e.g. disaster risk management, flooding etc.) ranked high on respondent lists of biggest current challenges, and only slightly more than a quarter of respondents reported that reducing GHG emissions was even somewhat important to their council. However, a majority of respondents considered many of the potential climate change impacts to be at least moderately likely in their area. Respondents also generally perceived the potential climate change impacts to be negative with few respondents predicting positive impacts in their communities. Taken together, these results suggest general awareness of the potential threats of a changing climate, but a lack of urgency and priority when it comes to taking action. In fact, updating flood risk maps was the only area in which a majority of respondents report current or future management changes and only 13% reported that adaptation plans will significantly differ to current plans. This does not mean that communities in New Zealand are not planning for adaptation and mitigation, but rather, as of this survey, responses were varied or uncertain. This result is consistent with the findings of [Hughey et al. \(2016\)](#) who surveyed the New Zealand public about their perceptions of the environment. They found in successive surveys between 2010 and 2016 that, while increasing numbers of New Zealanders saw climate change² as the largest environmental issue facing the world, the perception that climate change was the most important environmental issue facing New Zealand did not increase (indeed, it was ranked the most important environmental issues facing New Zealand by less than 10% of respondents in 2016).

New Zealand's decentralized approach to climate change adaptation has the potential to promote efficient, place-based locally suitable advances, but also increases the risk of fragmented, low-impact action ([Pelling et al., 2008](#); [Reisinger et al., 2010](#)). Of the local government representatives surveyed here, half report current planning or action on adaptation. Because recent work on adaptation has suggested that some adaptation planning has yet to be implemented ([Berkhout et al., 2006](#); [Adger et al., 2007](#); [Dovers, 2009](#); [Berrang-Ford et al., 2011](#)), respondents were asked to explain what prevents them from planning and taking action. Contrary to what has been found in other areas ([Tribbia and Moser, 2008](#); [Crabbé and Robin, 2006](#); [Archie et al., 2012, 2014](#)) issues related to information did not take center stage. While respondents do consider a lack of locally specific information to be a major barrier to planning, the same number of respondents also report that planning for climate change is just not a priority in their community, and the biggest reported barrier to planning was budget constraints. When asked about the hurdles to implementing adaptation plans, answers that deal with the public - top the list, such as "lack of public awareness or demand to take action" and "lack of perceived importance to the public". In response to the same question, 'no legal mandate to implement adaptation plans' (64%) was surprisingly prevalent, and reflects a lack of legal understanding. For example, section 7 of the Resource Management Act 1991 requires councils to have particular regard to the effects of climate change; and the Soil Conservation and Rivers Control Act 1941 gives regional councils the mandate to protect communities from flooding (the impacts of which are forecast to be amplified by climate change), and undertake physical works to mitigate erosion damage.

Adaptation in New Zealand has traditionally taken a back seat to discussions of mitigation, but is now edging towards becoming a national-level priority with designated task forces such as the adaptation technical working group housed in the Ministry for the Environment ([Manning et al., 2015](#); [Gluckman, 2013](#); [Nottage et al., 2010](#); [Evans et al., 2014](#); [Hayward, 2008](#)), spurred on by the increasing concern of local government ([LGNZ, 2017](#); [Pearce, 2017](#)). However, national governments do not necessarily provide resources to support or build local-scale adaptive capacity ([Smit and Wandel, 2006](#)). Issues related to public perceptions of climate change was a recurring theme which topped both the list of factors preventing adaptation implementation as well as the list of factors that would motivate increased mitigation action. Similarly, the results from the regression analysis showed that respondents who believed that climate change was not a priority in their community were less likely to report action. Altogether, it appears that climate change adaptation and mitigation will have to become a bigger priority to the public and in the community before other barriers – such as those related to information – can be properly addressed. Moving climate change up the priority list for the public can be accomplished through education, but may happen automatically as the impacts of climate change become increasingly obvious.

When it comes to mitigation efforts some of the same themes emerge. Despite global perceptions of New Zealand as a conscientious participant in global climate negotiations, the exit from Kyoto, watered-down ETS and a change from global leader to fast-follower status suggest modest mitigation efforts ([PCE, 2017](#); [Harker et al., 2016](#); [Renwick et al., 2015](#)). As mentioned previously, only slightly more than a quarter of respondents consider the goal of reducing GHG emissions as important to their council/board and roughly the same number report their council/board has a mitigation plan either in place or under development. A mere 15% of respondents currently measure and report the emissions associated with their own operations with even less keeping track of those within their jurisdiction. Despite rather dismal levels of current engagement in mitigation activities, it appears that the majority of councils could be motivated to action. The potential for co-benefits is an important concept highlighted by responses to questions about what would motivate increased mitigation efforts. It would appear that mitigation itself is not a sufficient motivator, but potential for action increases when mitigation strategies couple reducing GHG emissions with other environmental and economic benefits to the community ([Chapman et al., 2016](#); [Howden-Chapman et al., 2015](#)).

Most of the respondents report a high level of connectivity between geographically proximate communities with nearly half of the respondents reporting that decisions made by neighboring communities frequently or always affect their own decision making. Thus, decision making is contagious – planting a seed of action in one community can make nearby communities more likely to respond in

² 'Climate change' was broadly defined in this survey as covering emissions of greenhouse gases (including ozone) and changes in global or regional climate patterns.

similar ways. In responding to climate change this can be positive or negative depending on the type of action that is taking place. While proactive planning could catch on for an entire region, and site-specific differences in potential hazards could in principle lead to maladaptation, an insufficient response seems more likely at this stage.

Slightly more than half of respondents consider climate change to be a serious problem, which aligns directly with other surveys of the general population of New Zealand (Leining and White, 2015; Aitken et al., 2011). Prior survey research shows that public concern about climate change in New Zealand is decreasing, with the number of respondents who consider it an urgent problem falling 23% between 2008 and 2012 (Leining and White, 2015). Researchers suggest this could be due to global climate narratives and changes in government policies regarding climate change during the same time period (Hopkins et al., 2015; Leining and White, 2015). In this sample, local government officials cite a lack of public support as one of the main reasons for lagging local action (both adaptation and mitigation) on climate change. If local perceptions are largely shaped by national policies as suggested by the polls then local action is indirectly tied to national level prioritization of climate change response. Similar studies of New Zealanders have suggested that distanced perceptions of risk limits both individual-scale response and support for national-scale response (Hopkins et al., 2015).

Thus, increasing local-scale response hinges on public perception of the urgency of climate change, which is heavily influenced by national priorities, but support for national level response is limited by the collective view of climate change as a distanced problem. While there is some more recent evidence that belief in human-caused climate change is beginning to increase again in New Zealand (Milfont et al., 2017), it remains the case that if the public continues to view climate change as a distant problem – both geographically and temporally – neither national nor local scale measures are likely to garner high levels of support.

5. Conclusion

Local government elected representatives in New Zealand have been slow to adopt changes to management plans in order to proactively adapt to climate change. There is a relatively low level of awareness of the extent of the climate change impacts that can reasonably be expected at the local authority level. For example, we found that management plan changes around mitigation such as pursuing renewable energy opportunities, and limiting or reducing emissions were notably sparse; with fewer than 20% of respondents reporting emission reduction plans for their jurisdiction.

Two major factors seem to lie behind the limited level of engagement of local government elected representatives with climate change mitigation and adaptation. One is the tepid level of concern and action on the part of New Zealanders in regard to climate change. When asked about barriers to adaptation planning and implementation, responses repeatedly highlight the importance of public perception and support for action on climate change. This echoes the results of other recent surveys which have pointed to climate change not being a high priority for most New Zealanders (Leining and White, 2015; Aitken et al., 2011). A second key factor is the relatively low level of engagement by the central government in New Zealand on both mitigation and adaptation policy action. Not only have New Zealand's GHG emissions continued to increase (24% in gross terms, between 1990 and 2015) but national level policy action has been minimal for most of the last decade, since the Emissions Trading Scheme was enacted in 2008. The data presented here demonstrate a link between concern about climate change and progress toward adaptation planning and action. Recent trends suggest that levels of concern are likely to rise in the future with increasingly clear manifestations of climate change impacts which should in turn spur action at all levels.

Despite the findings of this survey-based study, there are signs that, following the 2015 Paris climate conference (where 195 countries adopted the first-ever universal, legally binding global climate deal) sentiment at the local authority level in New Zealand is beginning to change. In particular, the tone of a recent Mayoral Forum on climate change suggests growing impatience to take meaningful action in the face of the need for mitigation and adaptation (LGNZ, 2017). Similarly, the capital city of Wellington recently gained momentum toward adaptation planning by commissioning a report from the National Institute of Weather and Atmospheric Research (NIWA) which details regional impacts of climate change to the end of the century (Pearce et al., 2017). Steps such as these send clear messages that at least some New Zealand representatives are aware that change is coming and they are willing to take action. The larger question of how to go about melding a piecemeal regional approach into a nationwide response to climate change remains to be answered.

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Conflicts of interest

None.

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